

## CLAIMS

I claim :

- 5 1. An ion source comprising an electron producing cathode, an anode, an ionization region between said cathode and said anode, a gas supply path for introducing an ionizable gas into said ionization region, means for creating a potential difference between said cathode and said anode to produce a flow of electrons from said cathode toward said anode, said electron flow passing substantially through said  
10 ionization region and causing ionization of said gas, said potential difference also acting to expel ions created in said ionization region from said ion source, means for concentrating said electron flow to create a region within said ionization region where the electron flux is a maximum, wherein said gas supply path terminates in at least one aperture disposed in proximity to said region of maximum electron flux.  
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2. An ion source according to claim 1 wherein said potential difference creates an electric field extending away from the anode, the ion source further comprising a magnet producing a magnetic field, the axis of which is substantially parallel with said electric field.  
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3. An ion source according to claim 2 wherein the magnet is disposed such that the maximum of magnetic field intensity is disposed on an axis of the electric field and on the anode side of the ionization region.
- 25 4. An ion source according to claim 1 wherein said means for concentrating said electron flow comprises a projection of said anode extending into said ionization region.
5. An ion source according to claim 4 wherein said projection provides an outlet  
30 member of said gas supply path and comprises one or more apertures for introducing said ionizable gas into said ionization region.

6. An ion source according to claim 4 wherein said anode comprises an end wall, a side wall extending from the end wall in the direction of the cathode and sloping outwardly in the direction from the end wall toward the cathode such that the end wall and side wall together define a substantially conical ionization region with a closed end at the end wall and with an open end toward the cathode, wherein said projection extends from said end wall.
7. An ion source according to claim 6 wherein said gas supply path comprises one or more channels extending through said anode side wall, each of said channels terminating at an aperture disposed substantially adjacent the end wall.
8. An ion source according to claim 7 wherein each channel extends through the side wall in a direction generally toward the projection.
9. An ion source according to claim 4 wherein said gas supply path comprises one or more tubes extending into said ionization region, the, or each tube terminating in an aperture disposed adjacent the projection.
10. An ion source according to claim 9 wherein the, or each tube extends into the ionization region from the cathode end of the ionization region.
11. An ion source according to claim 4 wherein said projection has a sloped or curved surface having an apex disposed on an axis of the anode.
12. An ion source according to claim 1 wherein said anode includes an internal fluid channel adapted to receive fluid to cool said anode.
13. An ion source according to claim 4 wherein said anode includes a cavity adapted to receive fluid to cool said anode, said channel extending to an underside surface of the projection wherein the thickness of material of the projection between the ionization region and the cavity is less than 10mm.

14. An ion source according to claim 13 wherein the thickness of the material is less than 5 mm.
15. An ion source according to claim 13 wherein the thickness of material is less than 3mm.
16. An ion source according to claim 13 further comprising a fluid conduit extending into the cavity and terminating substantially adjacent the underside surface of the projection so that fluid provided through the fluid conduit is directed at the underside surface of the projection.
17. An ion source according to claim 1 wherein said anode is mounted on a base of electrically insulating material, said base including a channel forming part of said gas supply path.
18. An ion source according to claim 1 wherein said anode comprises at least one surface exposed to said ionization region, at least a portion of said at least one surface being of an electrically conductive non-oxidizing material.
19. An ion source according to claim 18 wherein said electrically conductive non-oxidizing material is Titanium Nitride.
20. An ion source comprising an electron producing cathode, an anode, an ionization region between said cathode and said anode, a gas supply path for introducing an ionizable gas into said ionization region, means for creating a potential difference between said cathode and said anode to produce a flow of electrons from said cathode toward said anode, said electron flow passing substantially through said ionization region and causing ionization of said gas, said potential difference also acting to expel ions created in said ionization region from said ion source, wherein said anode has at least one surface exposed to said ionization region, at least a portion of said at least one surface being of an electrically conductive non-oxidizing material.

21. An ion source according to claim 20 wherein said at least one exposed surface is a layer of Titanium Nitride coated onto said anode.

22. An ion source according to claim 20 wherein the anode comprises an end wall,  
5 a side wall extending from the end wall in the direction of the cathode and tapering outwardly in the direction from the end wall toward the cathode such that the end wall and side wall together define a substantially conical ionization region with a closed end at the end wall and with an open end toward the cathode, wherein the surfaces of the end wall and the side wall that are exposed to the ionization region are of an  
10 electrically conductive non-oxidizing material.

23. An ion source according to claim 22 wherein said anode further comprises a projection extending from the end wall into the ionization region, wherein the surface of the projection is of an electrically conductive non-oxidizing material.

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24. An ion source according to claim 20 wherein said potential difference creates an electric field extending away from the anode, the ion source further comprising a magnet producing a magnetic field, the axis of which is substantially parallel with said electric field.

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25. An ion source comprising an electron producing cathode, an anode, an ionization region between said cathode and said anode, a gas supply path for introducing an ionizable gas into said ionization region, means for creating a potential difference between said cathode and said anode to produce a flow of electrons  
25 produced by said cathode toward said anode, said electron flow passing substantially through said ionization region and causing ionization of said gas, said potential difference also acting to expel ions created in said ionization region from said ion source, wherein said gas supply path comprises a gas line terminating in an electrically conductive outlet member disposed within the ionisation region, said  
30 outlet member having one or more apertures therein for providing communication of gas from the gas line to the ionization region, and wherein said outlet member is in electrical contact with said anode.

26. An ion source according to claim 25 wherein said outlet member is disposed substantially at the centre of the anode.
- 5 27. An ion source according to claim 25 wherein said outlet member protrudes into said ionization region.
28. An ion source according to claim 25 wherein the, or each, aperture introduces gas into the ionization region at a localized area.
- 10 29. An ion source according to claim 25 wherein said anode comprises an end wall, a side wall extending from the end wall in the direction of the cathode and sloping outwardly in the direction from the end wall toward the cathode such that the end wall and side wall together define a substantially conical ionization region with a closed end at the end wall and with an open end toward the cathode, and wherein said outlet member extends from, and is in electrical contact with, said end wall.
- 15 30. An ion source according to claim 25 wherein said potential difference creates an electric field extending away from the anode, the ion source further comprising a magnet producing a magnetic field the axis of which is substantially parallel with said electric field.
- 20 31. An ion source comprising an electron producing cathode, an anode, an ionization region between said cathode and said anode, a gas supply path for introducing an ionizable gas into said ionization region, means for creating a potential difference between said cathode and said anode to produce a flow of electrons produced by said cathode toward said anode, said electron flow passing substantially through said ionization region and causing ionization of said gas, said potential difference also acting to expel ions created in said ionization region from said ion source, wherein said anode comprises an end wall, a side wall extending from the end wall in the direction of the cathode and sloping outwardly in the direction from the end wall toward the cathode such that the end wall and side wall together define a
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substantially conical ionization region with a closed end at the end wall and with an open end toward the cathode, and wherein said gas supply path comprises one or more channels extending through said anode side wall, each of said channels terminating at an aperture disposed substantially adjacent said end wall.

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32. An ion source according to claim 31 further comprising an electrically conducting projection extending from, and in electrical contact with, said end wall.

33. An ion source according to claim 31 wherein each channel extends through the side wall in a direction generally toward the end wall.

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34. An ion source according to claim 31 wherein said potential difference creates an electric field extending away from the anode, the ion source further comprising a magnet producing a magnetic field, the axis of which is substantially parallel with said electric field.

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35. An ion source comprising an electron producing cathode, an anode, an ionization region between said cathode and said anode, a gas supply path for introducing an ionizable gas into said ionization region, means for creating a potential difference between said cathode and said anode to produce a flow of electrons produced by said cathode toward said anode, said electron flow passing substantially through said ionization region and causing ionization of said gas, said potential difference also acting to expel ions created in said ionization region from said ion source, wherein said anode comprises an end wall, a side wall extending from the end wall in the direction of the cathode and sloping outwardly in the direction from the end wall toward the cathode such that the end wall and side wall together define a substantially conical ionization region with a closed end at the end wall and with an open end toward the cathode, and wherein said gas supply path comprises one or more tubes extending into said ionization region, each tube terminating in an aperture disposed adjacent the end wall.

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36. An ion source according to claim 35 wherein each tube extends into the ionization region from the open end of the ionization region.
37. An ion source according to claim 35 wherein each tube is comprised of a non-conducting material.
38. An ion source according to claim 35 wherein said potential difference creates an electric field extending away from the anode, the ion source further comprising a magnet producing a magnetic field, the axis of which is substantially parallel with said electric field.
39. An ion source according to claim 35 further comprising an electrically conducting projection extending from, and in electrical contact with, said end wall.
40. An anode for an ion source, the anode comprising an end wall, a side wall extending from the end wall and sloping outwardly in the direction away from the end wall such that the end wall and side wall together define a substantially conical region with a closed end at the end wall and with an open end at an end of the anode opposite the end wall.
41. An anode according to claim 40 further comprising a projection extending from said end wall into said conical region, said projection being electrically conductive and in electrical contact with said end wall.
42. An anode according to claim 41 wherein said projection is integrally formed with said end wall.
43. An anode according to claim 41 wherein said conical region is substantially symmetrical about an axis of the anode, said projection being disposed on said axis.
44. An anode according to claim 43 wherein said projection provides a sloping or curved surface having an apex disposed on said axis.

45. An anode according to claim 40 further comprising one or more channels for communicating a gas through the anode to the conical region.
- 5 46. An anode according to claim 45 wherein each of said channels terminates in an aperture in a projection extending from said end wall into said conical region, said projection being electrically conductive and in electrical contact with said end wall.
- 10 47. An anode according to claim 45 wherein each of said channels extends through said side wall and terminates in an aperture substantially adjacent said end wall.
48. An anode according to claim 47 wherein each channel extends through the side wall in a direction generally toward the end wall.
- 15 49. An anode according to claim 40 further comprising a cavity adapted to receive a cooling fluid.
50. An anode according to claim 49 wherein a thickness of said end wall between said conical region and said cavity is less than 5mm.
- 20 51. An anode according to claim 50 wherein a thickness of said end wall between said conical region and said cavity is less than 3mm.
52. An anode according to claim 49 further comprising a projection extending  
25 from said end wall into said conical region, said projection being electrically conductive and in electrical contact with said end wall, a thickness of said projection between said conical region and said cavity being less than 5mm.
53. An anode according to claim 52 wherein said cavity is adapted to receive a  
30 fluid conduit therein, said fluid conduit terminating substantially adjacent the underside surface of the projection so that fluid provided through the fluid conduit is directed at the underside surface of the projection.